

Chaerephon pumilus. By Sylvie Bouchard

Published 1 June 1998 by the American Society of Mammalogists

Chaerephon Dobson, 1874

Chaerephon Dobson, 1874:144. Type species *Molossus* (*Nyctinomus*) *johorensis* Dobson.
Nyctinomus Dobson, 1878:420.
Chaerephon Andersen, 1907:35.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Molossidae. The genus *Chaerephon* contains 13 species: *C. aloysiisabaudiae*, *C. ansorgei*, *C. bembelini*, *C. bivittata*, *C. chapini*, *C. gallagheri*, *C. jobensis*, *C. johorensis*, *C. major*, *C. nigeriae*, *C. plicata*, *C. pumilus*, and *C. russata* (Freeman, 1981; Koopman, 1993, 1994). The following key to species is derived from characters provided in Corbet and Hill (1992), Harrison (1975), Hayman and Hill (1971), Hill (1974):

- 1 Ears conjoined 2
Ears separated 6
- 2 Ears conjoined by triangular lappet of skin 3
Ears conjoined by unstructured band of skin 5
- 3 Large paired nasal inflations; length of forearm 37–39 mm *C. gallagheri*
No nasal inflations; length of forearm 42–50 mm 4
- 4 Color uniformly brown with white belly stripe; lack of well defined interaural pocket; length of forearm 42–44 mm *C. major*
Color blackish brown dorsally and no white stripe ventrally; well defined interaural pocket; length of forearm 46–50 mm *C. johorensis*
- 5 Color uniformly brown; length of forearm 48–54 mm *C. jobensis*
Color dark brown dorsally and lighter ventrally; length of forearm 40–50 mm *C. plicata*
- 6 Size larger, length of forearm 42–52 mm 7
Size smaller, length of forearm 34–42 mm 12
- 7 Paired caudal glands opening as slits on either side of tail root below; length of forearm 46–47 mm *C. bembelini*
Without such glands; length of forearm 42–52 mm 8
- 8 White spots, stripes, or lateral bands 9
Without white marks 10
- 9 Color umber brown with variable pattern of white spots or short stripes arranged laterally on crown and sometimes also on shoulders and flanks; length of forearm 46–51 mm *C. bivittata*
Conspicuous white lateral band below, along flanks at junction with membrane, contrasting with very dark brown color above and below; length of forearm 44–50 mm *C. nigeriae*
- 10 Color umber brown, top of head, neck, and throat darker, almost black; length of forearm 46–48 mm *C. ansorgei*
Color uniformly russet brown; length of forearm 42–52 mm 11
- 11 Length of forearm 42–46 mm *C. russata*
Length of forearm 50–52 mm *C. aloysiisabaudiae*
- 12 Length of forearm 34–39 mm; males with long (13–14 mm) bicolored postaural crest (dark basally, pale apically); light wings; color below light with whitish band down to the mid-belly *C. chapini*
Length of forearm 37–42 mm; males with short (≤ 10 mm) unicolored postaural crest; wings dark or light; color below variable, with or without white on the median area *C. pumilus*

Chaerephon pumilus (Cretzschmar, 1826)

Little Free-tailed Bat

Dysopes pumilus Cretzschmar, 1826:69. Type locality “Massawa,” Eritrea.
Dysopes limbatus Peters, 1852:56. Type locality “Mozambique Island” (15°S, 40°42'E), Mozambique.
Nyctinomus leucogaster Grandidier, 1869:337. Type locality “Mahab,” near Ménabé, east of Morondava, Madagascar.
Nyctinomus gambianus De Winton, 1901:39. Type locality Gambia.
Nyctinomus pusillus Miller, 1902:245. Type locality, Aldabra Island.
Nyctinomus hindei Thomas, 1904:210. Type locality “Fort Hall,” Kenya.
Chaerephon websteri Dollman, 1908:546. Type locality “Yola,” northern Nigeria.
Chaerephon pumilus naivashae Hollister, 1916:4. Type locality “Naivasha Station,” Kenya.
Chaerephon frater Allen et al., 1917:456. Type locality “Malela,” near Boma, Bas Zaire, Zaire.
Chaerephon (*Lophomops*) *cristatus* Allen et al., 1917:463. Type locality “Boma,” Bas Zaire, Zaire.
Chaerophon (sic.) *pumilus elphicki* Roberts, 1926:245. Type locality “Malelane Estate,” Barberton district, southeastern Transvaal, South Africa.
Chaerophon (sic.) (*Lophomops*) *nigri* Hatt, 1928:53. Type locality “Bourem,” Timbuetu district, Mali.
Chaerephon (*Lophomops*) *langi* Roberts, 1932:17. Type locality “Tsotsoroga Pan,” northern Botswana.
Tadarida (*Chaerephon*) *faini* Hayman, 1951:82. Type locality “Wago forest,” Haut Zaire, Zaire.

CONTEXT AND CONTENT. Context noted in generic summary above. No subspecies are attributed to *C. pumilus* due to its high dichromatism (Ansell, 1986; Hayman and Hill, 1971). Peterson et al. (1995) divides *C. pumilus* into four species: *Tadarida leucogaster*, *T. limbata*, *T. naivashae* and *T. pumila*.

DIAGNOSIS. *Chaerephon pumilus* can be distinguished from other members of the genus by lack of lobe projecting between the inner bases of ears, small size, length of forearm 37–42 mm, and male’s unicolor postaural crest, which measures ≤ 10 mm (Fig. 1; Hayman and Hill, 1971). The following skull characteristics also distinguish this species: reduced anterior palatal emargination which does not extend behind upper incisors and is separated from incisive foramina by a bony bar; third commissures of the last upper molars well developed and almost as long as the second commissure; basisphenoid pits shallow and separated at most by a low ridge; forehead distinctly elevated; length of maxillary tooththrow < 6.3 mm; interdental palate 30% shorter in width than in length (Fig. 2; Meester et al., 1986).



FIG. 1. Male *Chaerephon pumilus* from South Africa.

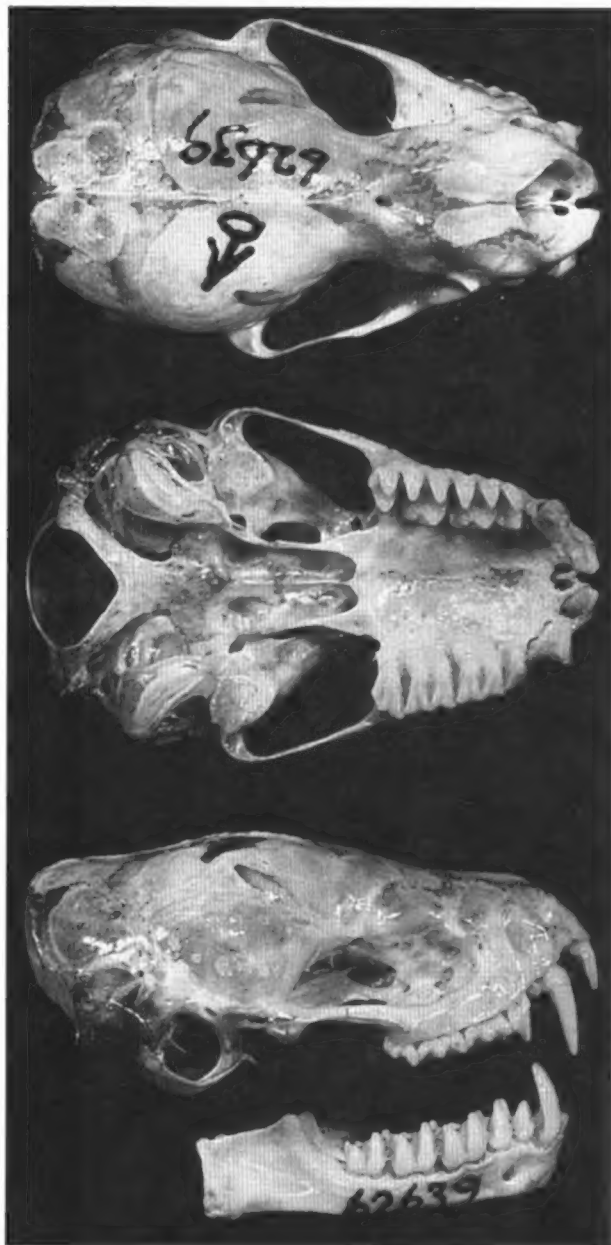


FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Chaerephon pumilus* from Botswana (20°00'S, 23°25'E; male, Royal Ontario Museum #62 639). Greatest length of cranium is 17.6 mm.

GENERAL CHARACTERS. *Chaerephon pumilus* is one of the smallest species within the genus *Chaerephon*, with a total length from 54 to 102 mm (Kingdon, 1974; Smithers, 1983). The dorsal fur is short blackish-brown and the ventral fur is lighter. White or pale hairs are present on the ventral surface where wings join flanks, and dark-winged and white-winged forms have been recorded (Happold, 1987; Hayman and Hill, 1971; Kingdon, 1974; Smithers, 1983). A fringe of pale bristles is present on the outermost toes (Kingdon, 1974). The ears are rounded and large for the size of the head. The antitragus is large and conceals the tiny tragus which is asymmetrically bilobed at the tip (Smithers, 1983). Males have a forehead tuft that makes their silhouette recognizable in flight (Kock, 1969).

Ranges of cranial measurements (in mm) in Upper Volta are as follows: total length, 15.2–16.2; zygomatic breadth, 9.1–9.8; mastoid breadth, 9.0–9.2; length of mandibular toothrow, 5.3–5.8; M3–M3, 6.1–7.2; length of maxillary toothrow, 9.9–10.5 (Poché, 1975). Means and ranges of external measurement (in mm) for 10 males and 20 females, respectively, from Zimbabwe are as follows:

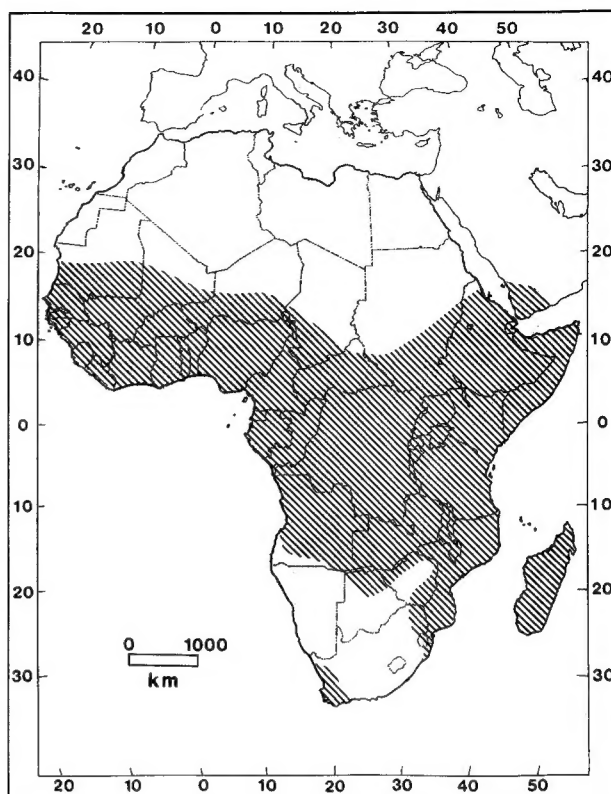


FIG. 3. Distribution of *Chaerephon pumilus* in Africa and the near east.

total length, 93 (90–98), 95 (90–100); length of tail, 36 (35–39), 35 (31–39); length of forearm, 38 (37–39), 38 (37–39). Average and ranges of mass (in g) for the same specimens are 11.1 (10.1–12.7), 11.3 (10.1–14.8) and for gravid females, 12.5 (11.2–15.1, $n = 19$ —Smithers, 1983). In Yemen, length of ear is 12 mm, tragus 2.5 mm, and the wingspan ranges from 250 mm to 260 mm ($n \geq 3$ —Al-Safadi, 1991).

DISTRIBUTION. *Chaerephon pumilus* occurs from Senegal to Yemen, south to South Africa, Bioko, Pemba and Zanzibar, Comoro Isls, Aldabra and Amirante Isls (Seychelles), and Madagascar (Fig. 3; Koopman, 1993). No fossils of this species are known.

FORM AND FUNCTION. The dental formula of the little free-tailed bat is $i\ 1/2, c\ 1/1, p\ 2/2, m\ 3/3$, total 30 (Peters, 1852). Juveniles have four milk teeth. The vertebral column has 7 C, 13 T, 6 L, 5 S, and 10 Ca, total 41. The keel of the sternum is weak and articulates with six pairs of ribs. The second finger has one phalange, the third finger has three, and the fourth and fifth also have three phalanges, but the last digit is short and bent (Peters, 1852).

The anterior portion of the tongue has flat, scale-like papillae, whereas the posterior portion has larger, more widely spaced, and wart-shaped papillae. Two salivary glands, ca. 7 mm in diameter, lie on each side of the neck. The larynx is ca. 5 mm long. The left lung has a single lobe and the right lung has two small lobes. The heart is ca. 10 mm long and 5 mm wide. The esophagus opens near the diaphragm and into a large saclike stomach which continues into an alimentary canal which is ca. 130 mm wide. The liver has a weak indentation in the middle and a deep indentation on the right side where its greatest mass lies. The gall bladder is located in the deep indentation of the liver. The spleen is ca. 15 mm long and its greatest width is ca. 4 mm. Kidneys are bean-shaped and measure ca. 6 mm long and 4 mm wide. The right kidney lies much deeper than the left one. *C. pumilus* has a thin-walled urinary bladder which in males is encircled from its neck around both sides by the prostate glands (Peters, 1852).

The penis of the little free-tailed bat is soft and does not have a baculum. Testes are long (ca. 4 mm), are lodged beside the root of the penis, and protrude into the skin (Peters, 1852). Combined

weight of testes in adult males does not show seasonal variation in Uganda, but remains constant throughout the year at ca. 0.1 g (Mutere, 1973). Adult males possess mature epididymal spermatozoa all year, but they do not undergo continuous spermatogenesis (Marshall and Corbet, 1959).

Females have a bicornuate uterus. No sign of atrophication is present in the left horn of nonpregnant individuals, and the size and appearance of both horns are similar; however, implantation occurs almost unilaterally in the right horn (Mutere, 1973). Histological examination of a pregnant and lactating female showed mammary glands that were greatly hypertrophied, measuring 14 mm by 11 mm in diameter and extending to within 5 mm of the spine posteriorly. Many glandular acini were fully distended with milk and had a lining epithelium that appeared flat. Other acini were empty and possessed secretory columnar epithelium where the distal part of the epithelial cells contained either globules of secretion or were broken off. The right horn of the uterus was swollen due to an early pregnancy. At a crown-rump length of 3.3 mm, limb buds of the embryo were just developed and sagittal sections revealed that differentiation of forebrain, tongue, heart, and liver were complete (Mutere, 1973).

Specimens of either sex of the little free-tailed bat collected in Kenya prior to the dry season have large quantities of subcutaneous fat. Females have heavy fat deposits during both gestation and lactation (O'Shea and Vaughan, 1980). In captivity little free-tailed bats became torpid during the day at 21–24°C (Happold and Happold, 1988).

Chaerephon pumilus is adapted to fast flight in open areas. It uses high intensity, shallow frequency-modulated calls of low frequency and long duration. These calls, although susceptible to interference from clutter, are ideally suited for long-range detection of prey in open areas. *C. pumilus* has narrow, long-tip wings for its size, a high aspect ratio (8.90), a high wing loading (12.6 N m⁻²), and a low wingtip shape index (1.2) which indicates a low level of maneuverability (Aldridge and Rautenbach, 1987; Findley et al., 1972; O'Shea and Vaughan, 1980; Vaughan, 1966). The minimum distance between strings (mounted in the laboratory) that *C. pumilus* can negotiate is 44 cm, whereas other African bats can fly between strings 11 cm apart (Aldridge and Rautenbach, 1987). The flight membrane is strong, leathery, and elastic. Ears are broad relative to their length and lie against the head when in flight to reduce drag. Airfoils of high camber are formed by connective tissue that braces anterior and ventral borders of the pinnae. Weight of the head is compensated by carrying the occipital portion against the interscapular depression, placing the head closer to the body's center of gravity. The wrinkled lips spread outward when in flight and increase the area available for catching insects. This may compensate for lack of maneuverability during fast flight (Vaughan, 1966). Roosting bats shorten their wings by folding them. Joints of the third finger flex upon one another and the first joint rotates considerably on the metacarpal, in order that the fold may be tucked sideways beneath the wing (Rosevear, 1965).

ONTOGENY AND REPRODUCTION. *Chaerephon pumilus* is polyestrous with females experiencing postpartum estrus (Happold and Happold, 1989; McWilliam, 1987; van der Merwe et al., 1986, 1987). Females become sexually mature in the breeding season following their birth, but the age at which this occurs varies with location. In the Transvaal, sexual maturity is attained at 5–12 months (van der Merwe et al., 1986). McWilliam (1987) reported a 3-month-old sexually mature female in Ghana that gave birth at 5 months. In Malawi, sexual maturity in females is attained at 6–10 months (Happold and Happold, 1989). Sexual maturity in four banded males occurred ca. 5 months in Ghana (McWilliam, 1987), whereas data are inconclusive in Malawi (Happold and Happold, 1989).

Pregnancies have been reported at various times throughout the year, timing that may be a function of rainfall patterns (Happold and Happold, 1989). Studies in Burkina Faso, Niger, Nigeria, and Sudan (all north of 10°N latitude) report collection of pregnant females or females simultaneously pregnant and lactating at different times of the year: in Niger (Poché, 1975) and Nigeria (Harrison, 1958), one pregnant and one pregnant and lactating female, respectively, in May; in Burkina Faso (Koopman et al., 1978), one pregnant female at the end of August; in Sudan (Kock, 1969), 23 pregnant females out of 32 females with immatures in October. Naked young were found in Sudan in June. Rainy season in these

countries begins in May and ends in September, except for Sudan where it starts and ends one month later.

Between 10°N and 10°S, records of pregnancies and parturition are as follows: in May, one lactating and pregnant female in Somalia (Harrison, 1958); in November and March–April, parturition in Kenya—times which correspond to the periods of peak rainfall (O'Shea and Vaughan, 1980); in November, January, and June, >80% of females pregnant in Uganda (Mutere, 1973). Females from Uganda are polyestrous and in reproductive synchrony (Marshall and Corbet, 1959). In Uganda rain occurs throughout the year with a small peak in October and November and a large peak in April and May (Happold and Happold, 1989). In Ghana most females give birth at least three times a year, mostly during the wet season, which lasts from April to October; synchronized peaks occur in June, August, and early November. The capture of a juvenile and a female that was simultaneously lactating and pregnant in January during the dry season suggests that parous females could potentially give birth to five young per year, although the extent of breeding occurring outside the wet season is still unknown (McWilliam, 1987).

South of 10°S latitude, records of reproductive individuals include the following: in Mozambique (Lawrence and Loveridge, 1953), three females with large embryos in January; in Zimbabwe (Smithers and Wilson, 1979), pregnant females in April; and in Botswana (Smithers, 1971), a pregnant female in August, 47 pregnant females from October to November, and hairless young in November and February. The wet season in these three countries lasts from November to March. In Zambia pregnant females were caught in September, November, and December; both pregnant and lactating or only lactating females in December, February, and March; and sexually inactive females in April. From these data, Ansell (1986) concluded that three births per female take place during the rainy season, which lasts from November to April. Pregnancies occur from August to April in Kruger National Park, South Africa. Rain there starts in October and ends in March; however, minimum temperature may play a more important role in defining the breeding season than rainfall, because it directly affects insect abundance at the higher altitudes found in the park (van der Merwe et al., 1986, 1987).

The little free-tailed bat is a monotocous species, with embryos almost always occurring in the right horn of the uterus (Happold and Happold, 1989; McWilliam, 1987; Mutere, 1973; van der Merwe et al., 1986, 1987), although twinning has been reported on one occasion (McWilliam, 1987). Gestation lasts for ca. 60 days in South Africa (van der Merwe et al., 1986) and Malawi (Happold and Happold, 1989) and 67–72 days in Ghana (McWilliam, 1987). Fetal weights range from 0.1 g to 3.5 g, the latter being those close to the time of parturition (Mutere, 1973). Young are born naked (Kock, 1969). Lactation lasts 2–3 weeks (Happold and Happold, 1989; Mutere, 1973; van der Merwe et al., 1986, 1987). Although the possibility of five births/year has been suggested, females generally give birth three times, with synchronization decreasing each time (McWilliam, 1987; Mutere, 1973; van der Merwe et al., 1986).

ECOLOGY. The little free-tailed bat is found in varied habitat from semiarid regions in the north to cleared rainforest regions in the south (Happold, 1987). These bats occur widely in savannas of Guinea and Sudan and in forests of the Congo basin in Zaire (Rosevear, 1965). They are found in savanna woodlands in Zambia, and in the Cape Province they occur in mountainous areas in the Cape Macchia Zone, as well as in more arid open country further north. They show a clear preference in Zimbabwe for low veld conditions and are never taken on the plateau over the 1,000 m level (Smithers, 1983).

Natural roosts of *C. pumilus* are hollows and crevices in trees, crowns of various species of palm (Kingdon, 1974), and rocky environments with an abundance of crevices in which colonies can take refuge in large number (Pienaar et al., 1987). In addition, *C. pumilus* is often found in human dwellings, mainly under thatched or corrugated iron roofs (Happold, 1987; Mutere, 1973; Pienaar et al., 1987; van der Merwe, 1986, 1987). Conditions of a roost under a roof in Uganda varied over the course of 1 year from 18°C to 50°C and from 35% to 90% relative humidity (Mutere, 1973). In Sudan little free-tailed bats prefer the north side of a building when it is shady and protected from the wind (Kock, 1969).

Size of the roosting colony varies from a few individuals (5–20) to hundreds (Happold and Happold, 1989; Kingdon, 1974;

Kock, 1969; Mutere, 1973; Smithers, 1971; Smithers and Wilson, 1979; Verschuren, 1957). Large colonies roosting in buildings are often considered a nuisance because of the smell of their droppings (Marshall and Corbet, 1959). Segregation according to age or sex does not occur, as adults of both sexes and juveniles are found together (Happold and Happold, 1989; Marshall and Corbet, 1959; Mutere, 1973).

Chaerephon pumilus often roosts with a larger molossid, *Mops condylurus* (Happold, 1987; Happold et al., 1987; Mutere, 1973; O'Shea and Vaughan, 1980). When roosting in trees, *C. pumilus* can be found with the palm swift, *Cypsiurus parvus*, which feeds on the same insects and like *C. pumilus* falls prey to the bat-hawk (Kingdon, 1974).

The little free-tailed bat is insectivorous, eating a wide variety of small, soft-bodied insects (Kingdon, 1974) that are consumed in flight (Pienaar et al., 1987). Lygaeidae (Hemiptera) constitutes 45% of the diet of bats captured in September–October in Kenya, while the remainder of the diet is distributed among the following: Coleoptera, 18%; Lepidoptera, 13%; Orthoptera, 8%; Diptera, 4%; other Hemiptera (Pentatomidae), 3%; Homoptera, 1%; Hymenoptera, 0.5%; Neuroptera, 0.5%; unidentified, 5% (Whitaker and Mumford, 1978). Although insect availability is similar during dry and wet seasons in South Africa, mean prey size of *Chaerephon pumilus* increases from 6.8 mm during the dry season to 8.5 mm in the rainy season (Ellis, 1995). One *C. pumilus* roosting in a building had apparently fed upon ants, as 21 heads were found attached to various parts of the bat's body (Whitaker and Mumford, 1978). Although *C. pumilus* and *Mops condylurus* are sympatric and often roost together, competition for resources is limited because the latter consumes larger prey items with hard integuments (Freeman, 1981; Whitaker and Mumford, 1978).

Stomachs of juveniles contain milk and remains of large cockroaches (*Leucophaea*), which have not been reported in adults. The cockroaches can attain lengths of 60 mm and are common in ceilings in which the young hang (Marshall and Corbet, 1959).

A requirement for drinking water in this species is thought to be minimal as three individuals that were kept in captivity for 10–60 days were never observed to drink. One female underwent pregnancy and lactation without drinking (Happold et al., 1987).

The bat-hawk (*Macheiramphus alcinus*), hobby falcon (*Falco subbuteo*), Wahlberg's eagle (*Aquila wahlbergi*), and the African goshawk (*Accipiter tachiro*) regularly prey upon *C. pumilus* (Fenton et al., 1994; Kingdon, 1974; Pienaar et al., 1987; Rautenbach et al., 1990). Little free-tailed bats also occasionally fall prey to the black kite, *Milvus migrans* (McWilliam, 1989). One African goshawk pair fed upon a large colony of *C. pumilus* roosting under a bridge in summer in South Africa. Capture rate was 1–5 bats per bird per evening. No predation on the same colony was observed during winter when emergence had dropped to <5% of that of summer (Rautenbach et al., 1990). Ectoparasites of *C. pumilus* include the mite *Chelanyssus aethiopicus* (Macronyssidae; Whitaker and Mumford, 1978) and the flea *Araeopysylla faini* (Ischnopsyllidae; Beaucornu, 1981).

BEHAVIOR. *Chaerephon pumilus* is a gregarious species. Colonies become very noisy and restless, squeaking and jockeying for position, 1 hour before individuals leave the roost (Smithers, 1983). Little free-tailed bats leave the roost in a line in small groups after sunset (Kingdon, 1974). In Uganda, time of emergence is not related to seasonal variation in light intensity but rather to sunset, the bats leaving 31–32 min after sunset throughout the year (Marshall and Corbet, 1959). In contrast, emergence behavior in Ghana is influenced by environmental, social, and reproductive factors (McWilliam, 1989). The bats start foraging earlier on overcast evenings than on clear or moonlit nights. Harem males usually come out first, which could reflect the risk of attacks associated with first emergence. Females emerge earlier during the first 3 weeks of lactation than during their pregnancies, probably in response to higher energy demands. The presence of a raptor modifies emergence behavior as bats increase synchronicity and depart in all directions (McWilliam, 1989).

Chaerephon pumilus forages singly and flight is fast and erratic. It hunts high above ground (≥ 70 m) in open sky, but also closer to the ground, making sudden swoops to within 3 m of it (Kingdon, 1974; Smithers, 1971, 1983). This species is active throughout the night with greatest flight activity during the hour following sunset, after which activity drops to a low around mid-

night followed by an even lower level before sunset (Mutere, 1969). Females are predominantly caught during the first hour after sunset (Happold et al., 1987; Mutere, 1969).

Recapture rates indicate that little free-tailed bats are capable of learning. Rates of capture decrease significantly from the first to second night if netting sites are not varied, suggesting that released individuals remember the placement of a trap. Little free-tailed bats also show homing abilities, as specimens released 70 km away from point of capture were recaptured at the original site 1 h later (Mutere, 1969).

In Ghana sex ratios in seven harems of *C. pumilus* found under roofs varied between 1:3 (male:parous female) and 1:21; young were also present (McWilliam, 1988). The heaviest males are associated with the largest harems. Roost fidelity is observed, as nine out of 13 females from one harem were found together for >1 year. Few movements are made between adjacent roosts. Disturbed colonies show group cohesion; seven of eight individuals from the same roost were recaptured together after their previous roost was invaded by ants. The same long term roosting association occurs in South Africa; colonies make no seasonal or local migrations (Pienaar et al., 1987). In Ghana some females are recruited into their natal group, although most young leave within their first year following sexual maturity. The mating system of *C. pumilus* is based on female-defense polygyny, although some resource defense might be involved as the number of roosts available becomes limiting (McWilliam, 1988).

Chaerephon pumilus is attracted to water holes, especially during the dry season. Individuals that fall into the water do not drown but swim to safety (Verschuren, 1976).

GENETICS. The karyotype of *C. pumilus* exhibits a diploid number of 48 and a fundamental number of 58. The karyotype shows one large and two medium metacentric chromosomes, three medium subtelocentric chromosomes, and 17 medium-small acrocentric chromosomes. The X chromosome is submetacentric, whereas the Y is acrocentric (Smith et al., 1986). *C. pumilus* is not known to hybridize with other species.

REMARKS. *Chaerephon* was formerly included in *Tadarida* as a subgenus, as skull characters used to distinguish it from *Tadarida* were not constant (Simpson, 1945; Tate, 1941). *Chaerephon* has been re-elevated to the level of genus by Freeman (1981:60, 133, 150), but other authors do not agree (Corbet and Hill, 1986; Legendre, 1984; Meester et al., 1986). Most recently, Peterson et al. (1995) do not retain *Chaerephon* as the genus because some species share characters from both the *Chaerephon* and *Mops* groups (J. L. Eger, pers. comm.). Nevertheless, *Chaerephon* has been here retained (Koopman, 1993). The specific name *pumila* was changed to *pumilus* to match the masculine generic name, *Chaerephon* (K. F. Koopman, pers. comm.). The generic name *Chaerephon* refers to the friend of Socrates who is depicted as "Chaerephon the bat" in Aristophanes' comedy, *Aves* (Dobson, 1874). The species name *pumilus* comes from the Latin, meaning "a dwarf."

LITERATURE CITED

- ALDRIDGE, H. D. J. N., AND I. L. RAUTENBACH. 1987. Morphology, echolocation and resource partitioning in insectivorous bats. *Journal of Animal Ecology*, 56:763–778.
- ALLEN, J. A., H. LANG, AND J. P. CHAPIN. 1917. The American Museum Congo expedition collection of bats. *Bulletin of the American Museum of Natural History*, 37:405–478.
- AL-SAFADI, M. M. 1991. Chiropteran fauna of Yemen Arab Republic. *Mammalia*, 55:269–274.
- ANDERSEN, K. 1907. Chiropteran notes. *Annali del Museo civico di storia naturale Giacomo Doria*, 3:5–45.
- ANSELL, W. F. H. 1986. Some Chiroptera from south-central Africa. *Mammalia*, 50:507–519.
- BEAUCORNU, J. C. 1981. A new flea from Rwanda. *Revue Zoologique Africaine*, 95:195–199.
- CORBET, G. B., AND J. E. HILL. 1986. A world list of mammalian species. Second ed. Facts on File Publications, New York, 254 pp.
- . 1992. The mammals of the Indomalayan region: a systematic review. Oxford University Press, Oxford, 488 pp.
- CRETZSCHMAR, P. J. 1826. Säugethiere, in *Atlas zu der Reise im nördlichen Afrika* (Eduard Rüppell, ed.). Senckenbergische naturforschende Gesellschaft, Frankfurt am Main, 78 pp.

- DE WINTON, W. E. 1901. Notes on bats of the genus *Nyctinomus*. *Annals and Magazine of Natural History*, ser. 7, 7:36–42.
- DOBSON, G. E. 1874. Description of a new species of Chiroptera from India and Yunan. *Journal of the Asiatic Society of Bengal*, 43:237–238.
- . 1878. Catalogue of the Chiroptera in the collection of the British Museum. Second ed. British Museum (Natural History), London, 567 pp.
- DOLLMAN, G. 1908. On a collection of bats from Yola, Northern Nigeria collected by Mr. G. W. Webster. *Annals and Magazine of Natural History*, series 8, 2:545–547.
- ELIUS, S. E. 1995. Seasonal responses of South African bats to insect densities and lights. M. S. thesis, York University, North York, Canada, 47 pp.
- FENTON, M. B., I. L. RAUTENBACH, S. E. SMITH, C. M. SWANEPOEL, J. GROSELL, AND J. VAN JAARSVELD. 1994. Raptors and bats: threats and opportunities. *Animal Behavior*, 48:9–18.
- FINDLEY, J. S., E. H. STUDIER, AND D. E. WILSON. 1972. Morphologic properties of bat wings. *Journal of Mammalogy*, 53: 429–444.
- FREEMAN, P. W. 1981. A multivariate study of the family Molossidae (Mammalia, Chiroptera): morphology, ecology, evolution. *Fieldiana Zoology*, 7:1–173.
- GRANDIDIER, A. 1869. 1. Travaux inédits. Description de quelques animaux nouveaux découverts, pendant l'année 1869, sur la côte ouest de Madagascar. *Revue et Magasin de Zoologie Pure et Appliquée*, 21:337–341.
- HAPPOLD, D. C. D. 1987. The mammals of Nigeria. Oxford University Press, Oxford, 402 pp.
- HAPPOLD, D. C. D., AND M. HAPPOLD. 1988. Renal form and function in relation to the ecology of bats (Chiroptera) of Malawi. *Journal of Zoology (London)*, 215:629–655.
- . 1989. Reproduction of Angola free-tailed bats (*Tadarida condylura*) and little free-tailed bats (*Tadarida pumila*) in Malawi (Central Africa) and elsewhere in Africa. *Journal of Reproduction and Fertility*, 85:133–149.
- HAPPOLD, D. C. D., M. HAPPOLD, AND J. E. HILL. 1987. The bats of Malawi. *Mammalia*, 51:337–414.
- HARRISON, D. L. 1958. A note on successive pregnancies in an African bat (*Tadarida pumila websteri* Dollman). *Mammalia*, 22:592–595.
- . 1975. A new species of African free-tailed bat (Chiroptera: Molossidae) obtained from the Zaire river expedition. *Mammalia*, 39:313–318.
- HATT, R. T. 1928. Note sur un chéiroptère nouveau du Soudan Français. *Bulletin de la Société Zoologique de France*, 53: 374–376.
- HAYMAN, R. W. 1951. A new African molossid bat. *Revue de Zoologie et de Botanique Africaines*, 45:82–83.
- HAYMAN, R. W., AND J. E. HILL. 1971. Part 2: Order Chiroptera. Pp. 61–64, in *The mammals of Africa: an identification manual* (J. Meester and H. W. Setzer, eds.). Smithsonian Institution Press, Washington, District of Columbia, 73 pp.
- HILL, J. E. 1974. New records of bats from south-eastern Asia, with taxonomic notes. *Bulletin of the British Museum of Natural History (Zoology)*, 27:127–138.
- HOLLISTER, N. 1916. Description of a new genus and eight new species and subspecies of African mammals. *Smithsonian Miscellaneous Collections*, 66:1–8.
- KINGDON, J. 1974. East African mammals, an atlas of evolution in Africa. Volume IIA. Academic Press, London, 341 pp.
- KOCK, D. 1969. Die Fledermaus-Fauna des Sudan. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft*, 521:1–238.
- KOOPMAN, K. F. 1993. Order Chiroptera. Pp. 137–241, in *Mammal species of the world: a taxonomic and geographic reference*. Second ed. (D. E. Wilson and D. M. Reeder, eds.). Smithsonian Institution Press, Washington, District of Columbia, 1206 pp.
- . 1994. Chiroptera: systematics. Walter de Gruyter, Berlin, 217 pp.
- KOOPMAN, K. F., R. E. MUMFORD, AND J. F. HEISTERBERG. 1978. Bat records from Upper Volta, West Africa. *American Museum Novitates*, 2463:1–6.
- LAWRENCE, B., AND A. LOVERIDGE. 1953. Zoological results of a fifth expedition to East Africa: 1. Mammals from Nyasaland and Tete. *Bulletin of the Museum of Comparative Zoology, Harvard*, 110:1–80.
- LEGENDRE, S. 1984. Étude odontologique des représentants actuels du groupe *Tadarida*, (Chiroptera: Molossidae). Implications phylogénétiques, systématiques et zoogéographiques. *Revue Suisse de Zoologie*, 91:399–442.
- MARSHALL, A. J., AND P. S. CORBET. 1959. The breeding biology of equatorial vertebrates. Reproduction of the bat *Chaerephon hindei* at latitudes 0°26' N. *Proceedings of the Zoological Society of London*, 132:607–616.
- MCWILLIAM, A. N. 1987. Polyestry and postpartum oestrus in *Tadarida (Chaerephon) pumila* (Chiroptera: Molossidae) in northern Ghana, West Africa. *Journal of Zoology (London)*, 213:735–768.
- . 1988. Social organization of the bat *Tadarida (Chaerephon) pumila* (Chiroptera: Molossidae) in Ghana, West Africa. *Ethology*, 77:115–124.
- . 1989. Emergence behaviour of the bat *Tadarida (Chaerephon) pumila* (Chiroptera: Molossidae) in Ghana, West Africa. *Journal of Zoology (London)*, 219:698–701.
- MEESTER, J. A. J., I. L. RAUTENBACH, N. J. DIPPENAR, AND C. M. BAKER. 1986. Classification of southern African mammals. Transvaal Museum, Monograph No. 5, Pretoria, 359 pp.
- MILLER, G. S., JR. 1902. Two new tropical Old World bats. *Proceedings of the Biological Society of Washington*, 15:245–246.
- MUTERE, F. A. 1969. Flight activity of tropical Microchiroptera, *Tadarida (Chaerephon) pumila* Cretschmar and *Tadarida (Mops) condylura* A. Smith. *Lynx*, 10:53–59.
- . 1973. Reproduction in two species of equatorial free-tailed bats (Molossidae). *East African Wildlife Journal*, 11: 271–280.
- O'SHEA, T. J., AND T. A. VAUGHAN. 1980. Ecological observations on an East African bat community. *Mammalia*, 44:485–496.
- PETERS, W. C. H. 1852. *Naturwissenschaftliche Reise nach Mosambique*, Zoologie: 1. Säugethiere, Berlin, 202 pp.
- PETERSON, R. L., J. L. EGER, AND L. MITCHELL. 1995. Chiroptères. Faune de Madagascar, 84. Muséum national d'Histoire naturelle, Paris, 204 pp.
- PIENAAR, U. DE V., S. C. J. JOUBERT, A. HALL-MARTIN, G. DE GRAAFF, AND I. L. RAUTENBACH. 1987. Field guide to the mammals of the Kruger National Park. C. Struik Publishers and the National Parks Board of Trustees, Pretoria, 176 pp.
- POCHÉ, R. M. 1975. The bats of National Park W, Niger, Africa. *Mammalia*, 39:39–50.
- RAUTENBACH, I. L., M. B. FENTON, A. C. KEMP, AND S. J. VAN JAARSVELD. 1990. Home range and activity of African goshawks *Accipiter tachiro* in relation to their predation on bats. *Koedoe*, 33:17–21.
- ROBERTS, A. 1926. Some new S. African mammals and some changes in nomenclature. *Annals of the Transvaal Museum*, 11:245.
- . 1932. Preliminary description of fifty-seven new forms of South African mammals. *Annals of the Transvaal Museum*, 15:1–19.
- ROSEVEAR, D. R. 1965. The bats of West Africa. *British Museum (Natural History)*, London, 418 pp.
- SIMPSON, G. G. 1945. The principles of classification and a classification of mammals. *Bulletin of the American Museum of Natural History*, 85:60.
- SMITH, S. A., J. W. BICKHAM, AND D. A. SCHLITZER. 1986. Karyotypes of eleven species of molossid bats from Africa (Mammalia: Chiroptera). *Annals of the Carnegie Museum*, 55:125–136.
- SMITHERS, R. H. N. 1971. The mammals of Botswana. *Memoires of the National Museum of Rhodesia*, 4:1–339.
- . 1983. The mammals of the southern African subregion. University of Pretoria Press, Pretoria, 736 pp.
- SMITHERS, R. H. N., AND V. J. WILSON. 1979. Check list and atlas of the mammals of Zimbabwe Rhodesia. *Memoires of the National Museum of Zimbabwe-Rhodesia*, 9:1–193.
- TATE, G. H. H. 1941. Molossid bats of the Archbold collections. *American Museum Novitates*, 1142:1.
- THOMAS, O. 1904. New bats from British East Africa collected by Mrs. Hinde and from the Cameroons by Mr. G. L. Bates. *Annals and Magazine of Natural History*, ser. 7, 13: 206–210.
- VAN DER MERWE, M., S. R. GIDDINGS, AND I. L. RAUTENBACH.

1987. Post-partum oestrus in the little free-tailed bat, *Tadarida (Chaerephon) pumila* (Microchiroptera: Molossidae) at 24°S. *Journal of Zoology* (London), 213:317–326.
- VAN DER MERWE, M., I. L. RAUTENBACH, AND W. VAN DER COLF. 1986. Reproduction in females of the little free-tailed bat, *Tadarida (Chaerephon) pumila*, in the eastern Transvaal, South Africa. *Journal of Reproduction and Fertility*, 77:355–364.
- VAUGHAN, T. A. 1966. Morphology and flight characteristics of molossid bats. *Journal of Mammalogy*, 47:249–260.
- VERSCHUREN, J. 1957. Écologie, biologie et systématique des Chiroptères. Exploration du Parc National de Garamba. Institut des Parcs Nationaux du Congo Belge, 7:1–473.
- . 1976. Les cheiroptères du Mont Nimba (Liberia). *Mammalia*, 40:615–632.
- WHITAKER, J. O., JR., AND R. E. MUMFORD. 1978. Foods and ectoparasites of bats from Kenya, East Africa. *Journal of Mammalogy*, 59:632–634.
- Editors of this account were CYNTHIA E. REBAR, KARL F. KOOPMAN, ELAINE ANDERSON, VIRGINIA HAYSEN, and ALICIA V. LINZEY. Managing editor was BARBARA H. BLAKE.
- S. BOUCHARD, DEPARTMENT OF BIOLOGY, YORK UNIVERSITY, NORTH YORK, ONTARIO, CANADA M3J 1P3.